3. NATURAL RESOURCES

3.1 INTRODUCTION

Natural resources in the Town of Carmel include numerous reservoirs, lakes, ponds, streams and wetlands, hilly topography and areas of forest land. These natural resources provide scenic, economic, health and ecological value to the Town and the surrounding region. The majority of the Town of Carmel is within the Hudson Highlands, Hudson River Estuary and within the New York City drinking watershed. Several of the lakes in Town are dedicated to the NYC drinking water system, in particular West Branch Reservoir, Lake Gilead and the Croton Falls Reservoir.

3.1.1 MAJOR ECOSYSTEMS

The Town is characterized by low and medium density/intensity development in the northwest and southeastern portions of the Town. This land cover type is defined by US Geographical Service (USGS) as commonly single-family housing and a mixture of constructed materials and vegetation, where 20-49% of the total cover area is characterized as impervious surfaces. Impervious surfaces are those such as asphalt, concrete, and rooftops, where water cannot filter through the material. This impermeability can mean that groundwater recharge (i.e., well water) is not occurring, and it means that stormwater tends to move across the impervious surface, gathering speed/velocity and pollution particles and often exacerbating flood impacts and polluting nearby bodies of water.

Ecosystem and landcover types found in Carmel are described in **Table 3.1**, of varying degrees of quality. Forest quality will be discussed later in the chapter.

TABLE 3.1. ECOSYSTEM TYPES

Ecological System	Description
Appalachian Hemlock-Hardwood Forest	Ranging from Central New England to Lake Erie, Virginia and West Virginia. Trees include sugar maple, yellow birch, and beech mixed with hemlock or white pine. Other tree species found may include red oak, tulip poplar, black cherry and black birch.
Central Appalachian Oak and Pine Forest	Cover areas from central Appalachians to central New England. Characterized by rolling hills to steep slopes with occasional occurrences on level topography. Soils are coarse and infertile, sometimes deep where glacial deposits exist in the northern ranges (as is the case of Carmel). These forests are mostly closed-canopy but can include patches of more open woodlands. It is dominated by a variable mixture of dry-site oak and pine

TABLE 3.1. ECOSYSTEM TYPES

Ecological System	Description
	species such as chestnut oak, white oak, red oak, black oak, scarlet oak, pitch pine, and white pine; these may occur as oak forest, mixed oak-pine forest, or patches of pine forest. Heath shrubs (hillside blueberry, huckleberry, and mountain laurel, etc.).
Central Appalachian Pine-Oak Rocky Woodland	This system of open or sparsely wooded hilltops and outcrops or rocky slopes occurs from the Central Appalachians north to New England. The tree canopy is patchy, mostly open woodland and often contains non-wooded openings. Pitch pine and/or Virginia pine are diagnostic and often are mixed with dry-site oaks (including black oak and scarlet oak) and sprouts of American chestnut (a functionally extinct [13] tree species). Some areas have a fairly well-developed heath shrub layer, others a grassy layer.
Introduced Upland Vegetation	Vegetation dominated (typically >60% canopy cover) by introduced species. These are spontaneous, self-perpetuating, and not (immediately) the result of planting, cultivation, or human maintenance. Land occupied by introduced vegetation is generally permanently altered (converted) unless restoration efforts are undertaken. Specifically, land cover is significantly altered/disturbed by introduced tree species.
Evergreen Plantation or Managed Pine	Even-aged, regularly spaced forest stands established by planting and/or seeding in the process of afforestation or reforestation where individual trees are generally > 5 meters in height. Specifically, this class refers to plantations dominated by evergreen species.
Gulf and Atlantic Coastal Plain Swamp Systems	These areas are saturated by rainfall and seasonal high water tables. Most are not associated with river floodplains, although one component system is a tidal swamp. In the North Atlantic Coastal Plain, Chamaecyparis thyoides, Acer rubrum, Liquidambar styraciflua, Nyssa sylvatica, Quercus phellos, and Fraxinus pennsylvanica are characteristic dominant.

[13] To be functionally extinct means that sprouts are unable to survive into adulthood and therefore reproduce.

TABLE 3.1. ECOSYSTEM TYPES

Ecological System	Description
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
Source: USGS GAP/LANDFIRE National Terrestrial Ecosystems, 2011.	

3.2 GEOLOGY, TOPOGRAPHY & SOILS

3.2.1 BEDROCK GEOLOGY

Bedrock geology is the solid rock that lies beneath soil, and often serves as the parent material for regolith (unconsolidated/broken rock material) and soil. Understanding the geologic makeup in the Town of Carmel is important to understand the potential feasibility of development. The bedrock in the Town dates to the middle Proterozoic (Mesoproterozoic) Era, a geologic era that occurred from 1,600 to 1,000 million years ago.

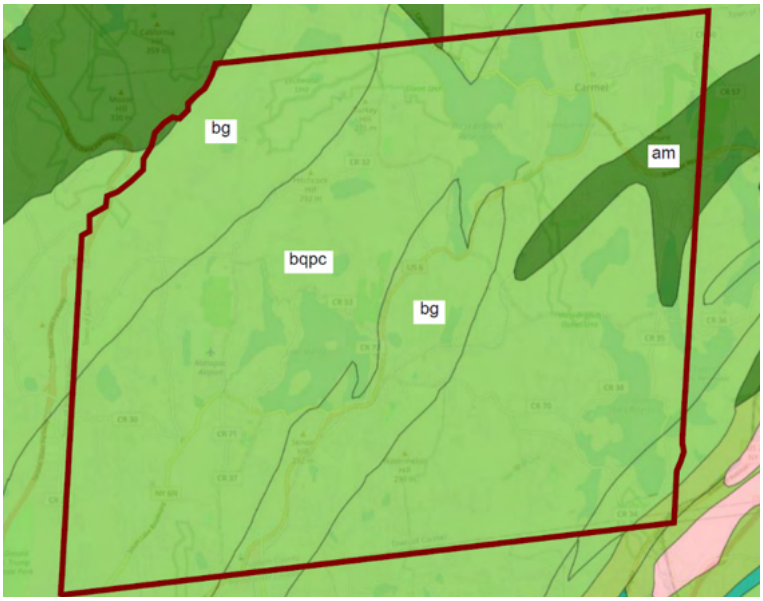


Figure 3.1. Bedrock Geology.

In Carmel, three types of bedrock predominate: Amphibolite (am- 4.4%), biotite-quartz-plagioclase paragneiss (bqpg - 69%) and biotite granite gneiss (bg - 24%). All three bedrock types are metamorphic, i.e., they are formed from other rocks that are changed because of heat or pressure, resulting in significant physical and chemical change. The Biotite granite and quartz formations continue through Putnam County and contribute to the geology of the Hudson Highlands, while the Amphibolite continues into Connecticut.

Putnam County's geology was predominantly shaped by glacial periods, when ice sheets approximately one-mile high covered the land, shaped it, scraped it and dragged rocks and soil to new places, leaving it behind when these sheets melted.[14]

The bedrock in Carmel is topped by what is considered "surficial geology"- this is the mineral base of unconsolidated rock materials that becomes soil when mixed with organic matter. Approximately 91% of the area in the Town of Carmel is "glacial till", unsorted glacial sediment which was deposited as the glaciers moved across the State and ground down the bedrock below. Some areas within the Town (6%) contains bedrock that is close to or at the surface (**Map 3**, **Surficial Geology**). These areas overlap with areas of biotite granite and quartz bedrock. Kame and outwash surficial bedrock are also present in Carmel and describe how the rock was deposited by glaciers or water. Kames are irregularly shaped hills or mounds of sand, gravel and till deposited by glaciers, and outwash are sands and gravels carried by running water from melting glaciers.

3.2.2 TOPOGRAPHY

The Town of Carmel is characterized by rolling, sometimes steeply sloping, hills and valleys eroded over time by glaciers and streams. Table 3.2 shows the approximate area of the Town that is dominated by steeply sloping land. Twenty-nine percent of the area of the Town contains slopes between 10-15%, and 14% of the land in Town is greater than 25% slope (**Map 4, Steep Slopes** and **Map 5, Elevation Contours**).

TABLE 3.2. SLOPES

Slope Range (%)	Acres*	% of Town
0-1.9 (lakes)	7,445	24%
2-10	3,422	11%
10.01-15	8,555	29%
15.01-20	4,051	13%
20.01-25	2,962	10%
25.01% +	4,330	14%

source: NYS 4 M. Digital Elevation Model
*Inaccuracies reflect the conversion of map data. Acreage should be considered approximations.

While the Town of Carmel regulations do not include definitions for steep slopes, it is accepted that land in excess of a 15% slope require additional engineering considerations if development is proposed, and land in excess of 25% is generally not well-suited to major development. **Map 4** shows the distribution of steep slopes in Carmel. The hilly topography of the Town is evident. The northeastern border of Town, adjacent to California Hill State Forest/Fahnestock State Park

[14] https://www.gufsee.org/geology.html

in the Town of Putnam Valley, features the largest area of steep slopes that are 20% or greater. The northeastern area of the Town has the highest elevations around 1,000 feet above mean sea level (msl) – there is essentially a plateau in this corner of the Town which slopes down to Peekskill Hollow Creek.

3.2.3 SOILS

Soil is a substance composed of the bedrock and other broken-down minerals from the surrounding area combined with organic matter. Soils regulate and filter water flow, decompose vegetative matter and other wastes, provide nutrients for agriculture and other plant life, sequester carbon as well as support infrastructure development. Forty-five percent (45%) of the soil area in Carmel is situated 6 feet or greater above subsurface bedrock and 45% of soils are between 2 and 4 feet above subsurface bedrock, i.e., shallow to bedroom. This measure is important when considering appropriate locations for development- it is more difficult and costly to build on bedrock.

Table 3.3 lists the major soil types found in the Town of Carmel, depicted in **Map 6**, **Soils.** Twenty-four percent (24%) of the Town is made up of Paxton fine sandy loam and Charlton-Chatfield complex forms another 23% of the area in Carmel. These are well drained soils composed of glacial till, which often form the moraines, drumlins and other glacially created hill formations that are found in Carmel. Although not technically a "soil", water contributes about 11.5 percent of the surface while urban land constitutes 2.2 percent.

TABLE 3.3. SOILS FOUND IN THE TOWN OF CARMEL

Soil Type	Acres	% of Town
Catden muck	586	2.2%
Charlton Fine Sandy Loam	2,344	9.0%
Charlton Loam	395	1.5%
Charlton Chatfield Complex	6,053	23.2%
Chatfield Hollis Outrcrop	1,152	4.4%
Fluvaquents-Udifluvents complex	298	1.1%
Fredon Silt Loam	11	0.0%
Hinckley loamy sand	13	0.0%
Hollis Outcrop	644	2.5%
Leicester Loam	486	1.9%
Natchaug muck	391	1.5%
Paxton fine sandy loam	6,302	24.2%
Quarry Pit	4	0.0%
Pompton Silt Loam	14	0.1%
Rayham Silt Loam	31	0.1%
Ridgebury complex	1,060	4.1%

TABLE 3.3. SOILS FOUND IN THE TOWN OF CARMEL

Soil Type	Acres	% of Town
Riverhead Loam	106	0.4%
Sun Loam	522	2.0%
Sutton Loam	276	1.1%
Udorthents	443	1.7%
Urban Land	566	2.2%
Water	3,001	11.5%
Woodbridge Loam	1,373	5.3%
Total	**28,858**	**12,739**

Source: NRCS Web Soil Survey, Putnam County, NY.
https://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/survey/

In New York State, prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. In Carmel, over 4,500 acres (17%) of soil cover is considered prime farmland and 16% or 4,000 acres is considered farmland of statewide importance. In total, 8,645 acres, or 33% of the soils in Carmel, are beneficial for farming. As described in the Land Use chapter, one farm operation is present in Carmel.

Hydric soils are those that are permanently or seasonally saturated by water. These soils indicate the potential presence of wetlands and therefore may not be suitable for development and may be regulated by the state (NYSDEC) or federally (ACOE). In the Town of Carmel, 11% or 2,980 acres of the Town's soils are hydric.

3.3 WATER RESOURCES

The Town of Carmel's landscape is dominated by water resources including numerous reservoirs, lakes and ponds, contributing streams and creeks, associated floodplains and wetlands.

Most of the Town of Carmel is located within the NYC Department of Environmental Protection Drinking watershed (DEP watershed). This means that water that enters or flows through the Town is conveyed to reservoirs that are owned/managed by the DEP, and which ultimately ends up as New York City drinking water.

Six (6) DEP watershed sub-basins cover the majority of the Town of Carmel, except for the northeastern and southeastern corners of Town (**Map 7, NYC DEP Lands and Watershed**). A watershed basin is an area defined by topography, where stormwater and surface water all flow to the same discharge point. The Town of Carmel contributes entirely or in part to the following DEP watersheds:

1. Amawalk
2. Muscoot
3. Croton Falls (Contains Croton Falls Reservoir)
4. West Branch (contains West Branch Reservoir)
5. Gilead
6. Gleneida

New York City owns Croton Falls, West Branch, Lake Gilead and Lake Gleneida as well as a portion of Kirk Lake. In total, the City owns over 6,000 acres of watershed land in the Town of Carmel. More information on how these water bodies and NYC drinking water are regulated by NYC DEP is located in the Utilities Chapter of this report.

3.3.1 LAKES & PONDS

The Town of Carmel, although several miles from the shore of the Hudson River, is within the boundaries of the Hudson River Estuary watershed, which means that free-flowing surface waters within the Town eventually empty out into the Hudson River. The Town contains a wealth of water resources ranging from lakes and reservoirs to ponds, wetlands, streams and aquifers.

FRESHWATER PONDS

The Town of Carmel contains around 140 freshwater ponds as classified by NYSDEC. Freshwater ponds are palustrine water bodies, which is a category that includes nontidal wetlands. This relationship is apparent on **Map 8**, where freshwater ponds and wetlands are coterminous or adjacent to each other. The defining feature of a freshwater pond is that they are less than 20 acres and no deeper than 2 meters.[15] Freshwater ponds in the Town of Carmel include: Lockwood Pond, Dixon Lake, Lake Ossi, Wixon Pond, Lake MacGregor, Mud Pond, Bloomer Pond, Lake Baldwin, Glencoma Lake and Teakettle Spout Lake.

3.3.2 STREAMS & WATER QUALITY

Numerous streams and tributaries cross the Town of Carmel in association with wetlands, floodplains and lakes/ponds. Major streams in Town include the Muscoot River, Secor Brook and two unnamed tributaries to the Croton Falls Reservoir.

The NYSDEC maintains a comprehensive Waterbody Inventory of water quality information for all waters in the state The Waterbody Inventory summarizes general water quality conditions and tracks the degree to which the water body supports its designated uses. Water quality for streams is tested, classified and monitored by the NYSDEC and includes the following classifications:

- AA/A- Drinking Water

[15] https://www.fws.gov/wetlands/documents/classwet/palustri.htm

- B- Best for swimming, contact recreation
- C- Best for fishing, non-contact recreation such as boating
- D- Impacted
- (T)- Supports Trout Populations
- (TS)- Supports Trout Spawning

Stream classifications are illustrated in **Map 9, Water Quality Classifications.** The Muscoot River is a class A(T), high quality trout supporting stream which is fed by class C/C(T) tributaries, among which is Secor Brook (C(T)).

The western tributary to Croton Falls Reservoir is a class A(TS) stream, which means that it supports trout spawning. The northern tributary to Croton Falls Reservoir is a class B stream, which includes class C tributaries.

The majority of minor tributaries other than those mentioned are class C streams. The wetland and stream complex west of West Branch Reservoir contains a class B trout supporting stream. This lower quality classification may be due to pollutants carried by stormwater from yards and roadways.

MUSCOOT RIVER & SECOR BROOK

The Muscoot River and Secor Brook is located in the southwestern portion of the Town, where the Muscoot River collects water from Lake Mahopac, Kirk Lake and Lake McGregor, and Secor Brook collects from Secor Lake. These two stream bodies join together just north of Stillwater Road to become the Muscoot River. A small tributary contributes to the waters of Lake Baldwin before running out into Westchester County and the Amawalk Reservoir.

The Muscoot River features extensive wetland complexes which accommodate the 100-year floodplain. Secor Lake in particular contains roughly 56 acres of wetland north and 11 acres south of the lake. Another wetland complex between Parker Drive and Sugarbush Court covers approximately 10 acres. Where the two branches meet, the associated wetland and floodplain spans approximately 240 acres.

MUD POND BROOK

Mud Pond Brook and its tributaries is located west of, and contributes to, Croton Falls reservoir. Mud Pond and Lake Casse contribute headwaters to this stream system, with Mud Pond also surrounded by approximately 80 acres of wetland. Due to the presence of Mud Pond itself these wetlands are not associated with a floodplain, likely because the volume of the pond and wetland are extensive enough to contain flood waters. In fact, Mud Pond Brook does not appear to contain significant floodplain anywhere along its reach. This is likely due to the steep topography of this area, which does not allow for water to overflow its banks. A southern tributary to Mud Pond Brook is surrounded by 45 acres of wetlands.

NORTH & WEST TRIBUTARIES TO CROTON FALLS RESERVOIR

As seen in **Map 8**, There are two primary stream complexes which contribute to the Croton Falls Reservoir. One connects the West Branch Reservoir to the western prong of the Croton Falls reservoir. This stream is not named but does contain a 100-year floodplain for most of its length. Some tributaries to this stream originate in a complex of wetlands and tributary streams which follow Drewville and Hickory Bend Road.

North of the eastern prong of the Croton Falls Reservoir, an unnamed tributary flows south from the Carmel hamlet/Town of Kent. South of Fair Street, the Fred Dill Wildlife Sanctuary protects 26 acres of wetland and floodplain area. It appears that an area of development south of Old Route 6 and north of Route 6, where Tops Friendly market is located has been developed over another wetland/floodplain complex, and it is likely that the tributary stream has been channelized or diverted underground at this location.

PRIORITY WATERBODIES LIST

In addition to designating surface waters for water quality purposes, the NYSDEC evaluates a subset of this inventory that is limited to segments with well documented, potentially resolvable, higher priority problems and issues. This subset of the Waterbody Inventory is the Priority Waterbodies List. The Waterbody Inventory summarizes general water quality conditions and tracks the degree to which the water body supports its designated uses. It also monitors progress toward the identification and resolution of water quality problems, pollutants, and sources. These reports are updated every five years.[16] Categorizations on the list range from impaired, minor impacts, threatened, needs verification and no known impact. In the Town of Carmel, seven of the lakes have been assessed as impaired or minor impacts and Lake Mahopac has been categorized as "no known impact", last tested in 2002. **Map 9** shows the water body classifications in the Town of Carmel.

IMPAIRED WATERS

The Federal Clean Water Act requires states to periodically assess and report on the quality of waters in their state, and to identify impaired waters. Impaired waters are where designated uses are not fully supported by the water quality. For these impaired waters/pollutants, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.[17]

[16] https://gisservices.dec.ny.gov/gis/hvnrm/layerInfo.html#pwl
[17] https://www.dec.ny.gov/chemical/31290.html

WEST BRANCH RESERVOIR

The last time data was revised for the West Branch Reservoir was in 2008. At that time, testing showed the reservoir to be an impaired water body because two of the intended uses, water supply and fish consumption, are threatened or impaired by the pollutant levels in the water. These pollutants include mercury and phosphorus derived from stormwater runoff from the surrounding roads and development. While the Total Maximum Daily Load for phosphorus was below the criterion established for the New York City Water Supply, the use is still classified as "threatened" because there remains a need to protect its resource value as a source of drinking water for a large population. In 2007 a Nonpoint Source Implementation Plan for this TMDL was developed to address these threats. Due to the presence of mercury, fishing in the West Branch Reservoir is considered impaired.

CROTON FALLS RESERVOIR

Similar to West Branch, the Croton Falls Reservoir is categorized as impaired due to the nature of the impaired use, drinking water supply. The drinking water supply is impaired by phosphorus loading from stormwater runoff entering the water body from surrounding impervious surfaces and other sources. The level of phosphorus in the Croton Falls Reservoir was above the TMDL limit established for the NYC Water Supply Watershed in 2008, and the report indicates that a Nonpoint Source Implementation Plan was in development at the time of the report.

MINOR IMPACTS

LAKES GLENEIDA & GILEAD

Use of Lake Gleneida and Lake Gilead for water supply and recreational use are impacted due to elevated nutrient concentrations from stormwater runoff and other nonpoint pollution sources. An influx of nutrients such as phosphorus promote algal blooms and reduce the dissolved oxygen in the water - a process which leads to eutrophication. A reduction in dissolved oxygen stresses aquatic species which rely on dissolved oxygen in the water to survive. Leakage from septic systems may also contribute to the pollution in these lakes.

LAKE OSSI

Use of Lake Ossi for recreational use is impacted from nonpoint pollution which inputs phosphorous and promotes algal blooms and eutrophication. It is believed that the nutrient loading to Lake Ossie is likely a result of agricultural or lawn fertilizers entering the lake.

KIRK LAKE

Use of Kirk Lake for recreation is minorly impacted by elevated nutrient (phosphorous) loading from stormwater runoff and other nonpoint source pollution. As this is part of the NYC drinking water system as well, the lake is incorporated into TMDL planning similar to West Branch and Croton Reservoir.

The numerous lakes and ponds in the Town of Carmel are connected by an extensive network of streams, wetlands and their associated floodplains. The Muscoot River, Mud Pond Brook, and tributaries connecting the West Branch to Croton Falls Reservoir are the predominant streams in the Town. Most of the streams in Town are surrounded by extensive wetland complexes, while only a few (Muscoot River and a West Branch Tributary) feature extensive floodplains. See **Map 8, Water Resources**.

When considering the surface waters within a community, it is important to consider two major factors: The floodplain and the water quality. Because of the steep topography in the Town of Carmel, only a few streams contain significant floodplains, therefore it is also important to consider wetlands, as these are often coterminous or more prevalent than floodplains in this instance.

3.3.3 FLOODPLAINS

The Federal Emergency Management Agency (FEMA) prepares floodplain maps which depict the location of the 100-year and 500-year floodplains associated with major streams and rivers. They are used to define those properties which should obtain flood insurance as part of the National Flood Insurance Program (NFIP) and are the basis for local flood damage prevention regulations. The following definitions apply when reviewing a flood map:

> Zone A, AE and AO: Areas subject to inundation by the 1-percent-annual-chance flood event (100-year flood area). Mandatory flood insurance purchase requirements and floodplain management standards apply in these areas. This is also considered the Area of Special Flood Hazard.
>
> Zone X: Areas of moderate flood hazard, also known as the .2 percent annual chance, or 500-year flood area.

In the Town of Carmel, development within the floodplain is regulated through Chapter 86 of the Town Code, "Flood Damage Prevention." No new structure may be constructed in the "Area of Special Flood Hazard" without obtaining a floodplain development permit. See **Map 8, Water Resources.**

3.3.4 WETLANDS

In the Town of Carmel, wetlands are regulated under multiple jurisdictions: local, state and federal. Wetlands shown on the map have been identified from two sources: the NYSDEC, and the U.S. Fish and Wildlife Service. The United States Fish and Wildlife Service publishes a series of National Wetland Inventory (NWI) maps that illustrate the location of smaller wetland systems - these wetlands are typically regulated by the ACOE. As defined by the U.S. Army Corps of Engineers (ACOE) and U.S. Environmental Protection Agency, freshwater wetlands are:

> "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

Wetlands include swamps, marshes, bogs, and similar areas. Wetlands are some of the most productive ecosystems, and provide nesting, spawning, and breeding habitat for a diverse variety of wildlife and plants. They perform vital ecosystem services, such as water filtration and storage, which can assist in reducing flood impacts and improve water quality by absorbing pollutants and reducing turbidity. Additionally, wetlands provide groundwater discharge; assist in maintaining base flow in streams and rivers and support ponds and lakes. They also provide opportunities for recreation, education and research, and provide natural open space.

The NYSDEC and the U.S. Army Corps of Engineers (ACOE) regulate activities that occur within or adjacent to freshwater wetlands. NYSDEC-designated wetlands are generally 12.4 acres and larger. Note that NYSDEC designated wetlands are also regulated by the ACOE. NYSDEC regulates activities in freshwater wetlands and in the associated 100-foot adjacent areas in order to prevent or minimize impairment of wetland functions. The ACOE regulates wetlands based on the presence of hydrophytic vegetation, hydric soils and hydrology, and regulates activities within the wetland – it does not regulate an adjacent area.

Activities that may occur within a NYSDEC or ACOE wetland require permits and may be prohibited to the extent that alternatives to an action would eliminate the need to disturb a wetland. Wetlands are also regulated at the local level in accordance with Chapter 89, Freshwater Wetlands, of the Town Code. As per Chapter 89, wetlands are categorized as follows:

Class I Wetlands

- Is resident habitat of an endangered or threatened animal or plant species;
- Is tributary to a body of water which could subject a substantially developed area to significant damage from flooding or from additional flooding should the wetland be modified, filled or drained;
- Is adjacent or contiguous to a reservoir or other body of water that is used primarily as a community or public water supply, or it is hydraulically connected to an aquifer which is used for community or public water supply; or
- It contains four or more of the enumerated Class II characteristics.

Class II Wetlands

- Inland wet meadows.
- Inland fresh marshes.
- Shrub swamps
- Wooded swamps

- Bogs and other areas of wetness in which shallow ponds may also be present.
- Submerged lands commonly called marshes, swamps, sloughs, and flats supporting aquatic or semiaquatic vegetation.
- Lands, submerged lands and overlying waters containing remnants of any vegetation that has died because of wet conditions over a sufficiently long period, providing that such conditions can be expected to persist indefinitely, barring human intervention.
- Underlying lands and waters enclosed by aquatic or semiaquatic vegetation as set forth herein or dead vegetation as set forth above.
- Soil types that are poorly drained, very poorly drained, alluvial or floodplain soils as defined by the USDA Soil Conservation Service and the Putnam County Soil and Water.
- It is within a publicly owned recreation area.

Class III Wetlands

- Seasonally or continuously flooded basins, flats, or watercourses which normally flow three months or more of the year.
- Bodies of water.

Class IV Wetlands

- A wetland shall be a Class IV wetland if it does not have any of the characteristics listed as criteria for Class I, II, or III wetlands.
- Watercourses which flow normally less than three months of the year.
- Land bordering a stream, built up by sediment from overflow of the stream and subject to inundation when the stream is in flood stage.

Wetland disturbance permits are required for any non-agricultural land disturbance activity within 100 feet of, or within a freshwater wetland. The Planning Board may refer any site plan or subdivision that may impact or include wetlands to the Environmental Conservation Board (ECB) for their review and comment. The ECB administers applications for wetland disturbance permits per §89-5 of Town Code, the application may include a public hearing and must be publicly noticed.

§89-10 of the Town Code lists the standards for permit issuance. Permits may be issued if 1) the disturbance is compatible with preservation, protection and conservation of the wetland; 2) the disturbance would result in no more than insubstantial degradation to, or loss of, any part of the wetland; 3) the disturbance would be compatible with the public health and welfare. Sub-section B of §89-10 provides guidelines for weighing impacts to each class of wetland as defined.

Wetlands are prominent throughout the Town and serve to link much of the surface water bodies such as minor stream tributaries to the ponds and lakes. Several wetland complexes are present west of the West Branch Reservoir and north of Lake Mahopac. These wetlands connect Long Pond, Dixon Lake, Lockwood Pond and Wixon Pond. A large, 100-acre wetland complex located at the northern tip of Kirk Lake is connected by a tributary to several smaller wetlands in the northwestern corner of Carmel.

3.3.5 AQUIFERS

Aquifers are subsurface water that contribute to groundwater recharge. Aquifers are important resources for drinking water, and it is important to keep them protected against pollutants which may infiltrate below the soil.

Unconfined aquifers are those that are below the surface but receive water from the ground surface while confined aquifers lie below an impermeable layer of rock or soil that prevents water from seeping into the aquifer from the ground.

The Town of Carmel contains two unconfined aquifers. One follows the northwestern boundary of the Town along the ridge. Another aquifer runs roughly from Croton Falls Road south to the southern boundary of Town.

The Town does not regulate activity within aquifer areas.

3.4 BIODIVERSITY & WILDLIFE

The Hudson River Estuary Program maps sensitive resources, wildlife habitats and forest conditions throughout the Hudson River Estuary of which the Town of Carmel is a part. In addition to mapping significant habitats for rare plants and animals, the organization also analyzes, and maps forest quality based on the size, density and makeup of forests. Forest quality is a helpful measure for habitat quality and environmental resilience, as intact forest cover can protect against heat waves, flooding during heavy rain events, and are shelter for many native plants and animals.

In general, the Town of Carmel's forest quality is within the 0-40th percentile of forest health. This rating is due to the forests being fragmented by residential and commercial development, roadways and the lakes, and likely contain higher instances of invasive plan species. Invasive species are non-native species of plants or animals that can cause harm to the environment, the economy or to human health and can contribute to habitat degradation and loss, crop damage and diseases in humans and livestock.[18]

In the northwestern corner of Town, close to Fahnestock State Park and where the steepest ridgelines are located, the forest condition index is higher quality, within the 60-80th percentile.

[18] http://essex.cce.cornell.edu/environment/invasive-nuisance-species/invasive-plants

This area contributes to a matrix forest which extends into and covers the majority of the Town of Putnam Valley, largely coterminous with Fahnestock State Park. This Chestnut oak forest is a matrix forests which are the largest, most intact forests in the northeastern United States "whose size and natural condition allow for the maintenance of ecological processes, forest communities, and populations of forest-interior dwelling species."[19] The forest is a designated significant natural community in the Town.

The Town of Carmel is part of the Hudson Highlands Significant Biodiversity Area (SBA). SBA's are landscape areas that contain high concentrations of biodiversity or unique ecological features. The Hudson Highlands SBA spans Dutchess, Orange, Rockland, Putnam and Westchester counties. Per a *Coastal Fish and Wildlife Rating Form* prepared by the NYS Department of State, the "Hudson Highlands is a critical habitat for most estuarine-dependent fisheries originating from the Hudson River. This area contributes directly to the production of in-river and ocean populations of food, game, and forage fish species."[20] To this point, the Muscoot River and tributaries to West Branch Reservoir have been identified as known important areas for migratory fish which may swim upstream to spawn and live out adulthood in the Hudson River Estuary.

The Carmel hamlet contains areas identified as important for rare plants by the NYSDEC Natural Heritage Program, including those listed in **Table 3.4.** In New York, the following describe protective status per Chapter 6 of NYCRR Part 182.2(g), (h) and (i):[21]

- **Endangered-** A native species in imminent danger of extirpation or extinction in New York
- **Threatened-** A native species likely to become an endangered species within the foreseeable future in New York
- **Special Concern-** A species is determined to be in some jeopardy due to adverse trends to which it is vulnerable, and if not monitored or ameliorated, could lead to more serious decline and listing as either an endangered or threatened species in New York or a species that is uncommon or restricted in its range in New York so that any reduction in its population or habitat may cause it to become threatened or endangered.

[19] https://gisservices.dec.ny.gov/gis/hvnrm/layerInfo.html#mfb
[20] https://www.dos.ny.gov/opd/programs/consistency/Habitats/HudsonRiver/Hudson_Highlands_FINAL.pdf
[21] https://www.dec.ny.gov/animals/7494.html#Special_Concern

TABLE 3.4. RARE PLANTS

Common Name	Scientific Name	State Protection Status
Alternate-flowered Water Milfoil	*Myriophyllum alterniflorum*	Threatened
Shining Bedstraw	*Galium concinnum*	Endangered
Southern Snailseed Pondweed	*Potamogeton diversifolius*	Endangered
Tooth Cup	*Rotala ramosior*	Threatened
Wild Hydrangea	*Hydrangea arborescens*	Threatened

Source: NYS Natural Heritage Program New York Nature Explorer.

Two areas within the Town have been identified as important habitat for rare terrestrial animals including the Indiana Bat, *Myotis sodalis*, (NYS and Federally endangered), the Northern Long Eared Bat, *Myotis septentrionalis* (NYS and Federally endangered) and the Bog Turtle, *Glyptemys muhlenbergii* (NYS Endangered, Federally threatened).[22]

Birds of Conservation Concern (BCC) are also found in the Town. These are protected under the 1988 amendment to the Fish and Wildlife Conservation Act which mandates the US Fish and Wildlife Service to ""identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act of 1973."[23] The following table lists rare birds found in the Town of Carmel or which migrate through the Town and their Federal and State protection status. In New York State, birds may be defined as "protected birds" which identifies species that may not be hunted or taken at any time.

[22] US Fish and Wildlife Service IPaC Project Planning Tool. https://ecos.fws.gov/ipac/location/P5GTTBYC6BGBBBA2PW2D2U4L7M/resources#endangered-species

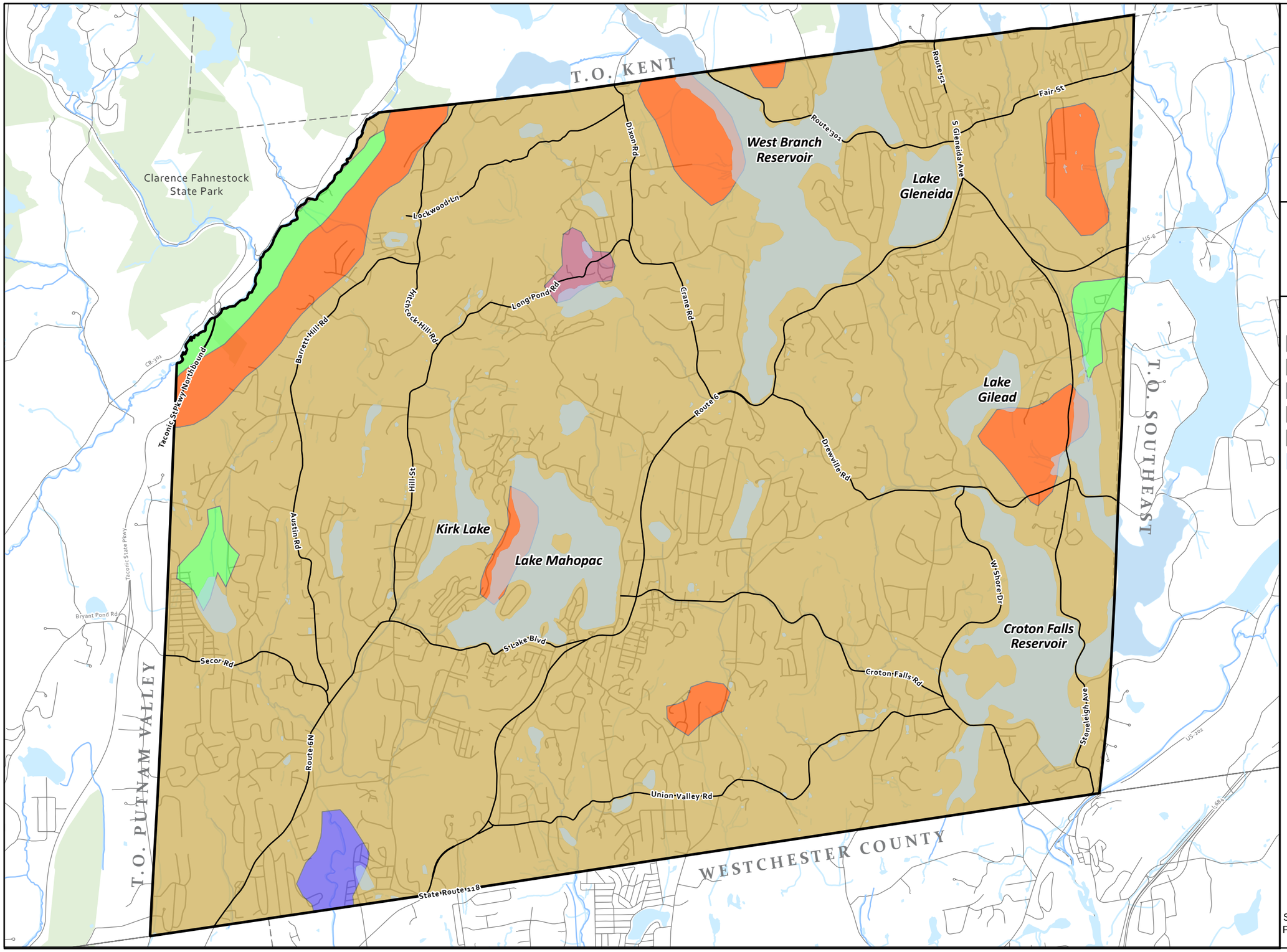
[23] https://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php

TABLE 3.5. RARE BIRDS IN CARMEL			
Common Name	**Scientific Name**	**NYS Protection Status**	**Federal Protection Status**
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Non-BCC, protected under the Bald Eagle Protection Act
Black Billed Cuckoo	*Coccyzus erythropthalmus*	Protected	BCC
Bobolink	*Dolichonyx oryzivorus*	Protected	BCC
Canada Warbler	*Cardellina canadensis*	Protected	BCC
Evening Grosbeak	*Coccothraustes vespertinus*	Protected	BCC
Golden Eagle	*Aquila chrysaetos*	Endangered	Non-BCC, protected under the Golden Eagle Protection Act
Prairie Warbler	*Setophaga discolor*	Protected	BCC
Red Headed Woodpecker	*Melanerpes erythrocephalus*	Special Concern	BCC
Rusty Blackbird	*Euphagus carolinus*	Protected	BCC
Wood Thrush	*Hylocichla mustelina*	Protected	BCC
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Protected	BCC
Source: NYS Natural Heritage Program New York Nature Explorer; NFWS IPaC Tool, 2019.			

Town of Carmel

Comprehensive Plan

Map 3
Surficial Geology



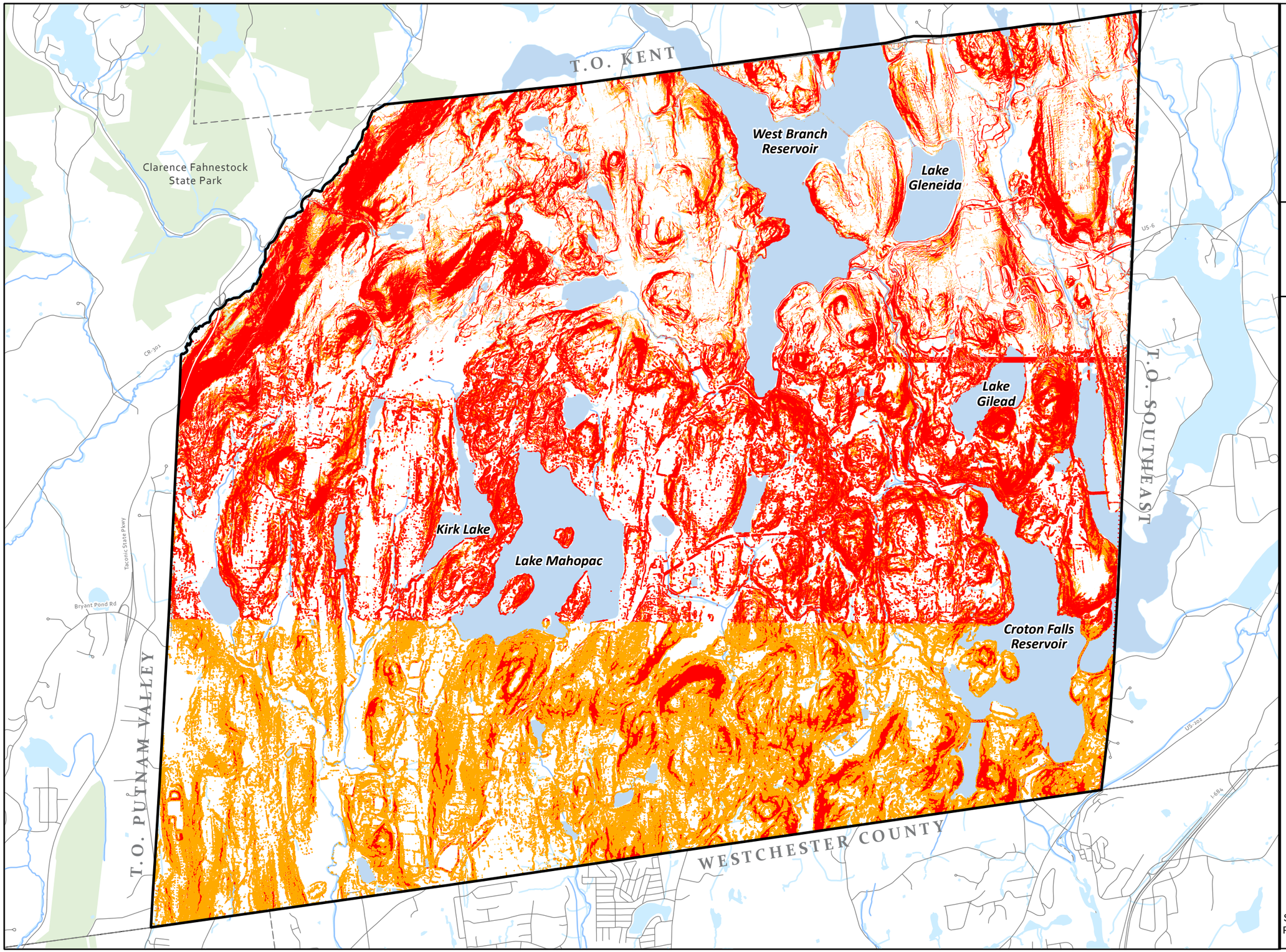
Surficial Geology Material

- Kame Deposits
- Outwash Sand and Gravel
- Swamp Deposits
- Bedrock
- Till
- Surface Water

N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse



Town of Carmel

Comprehensive Plan

Map 4 Slopes

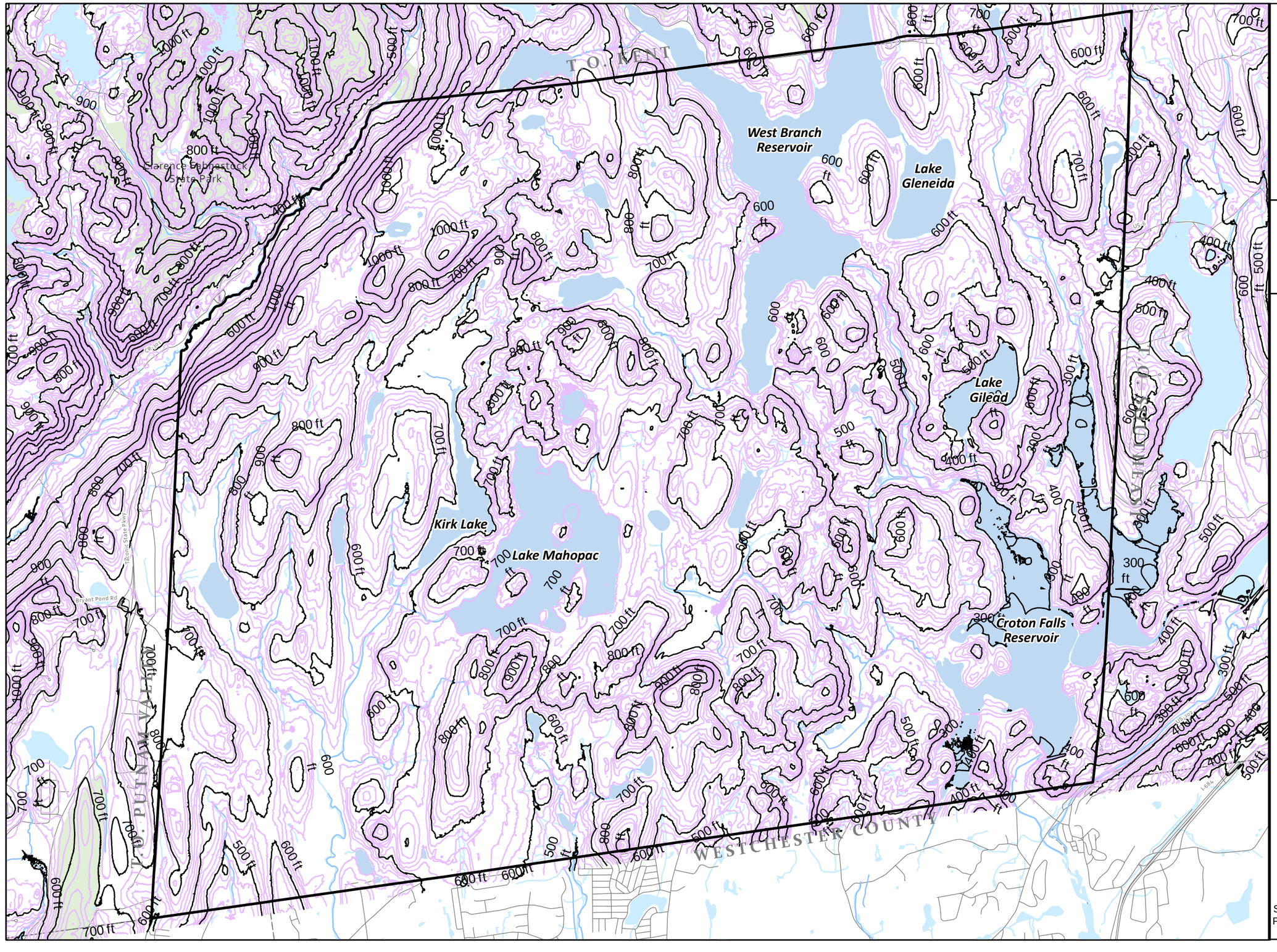
Slope Grade

- 15-20%
- Greater than 20%

N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse



Town of Carmel

Comprehensive Plan

Map 5 Contours

100 Ft Contour

20 Ft Contour

N

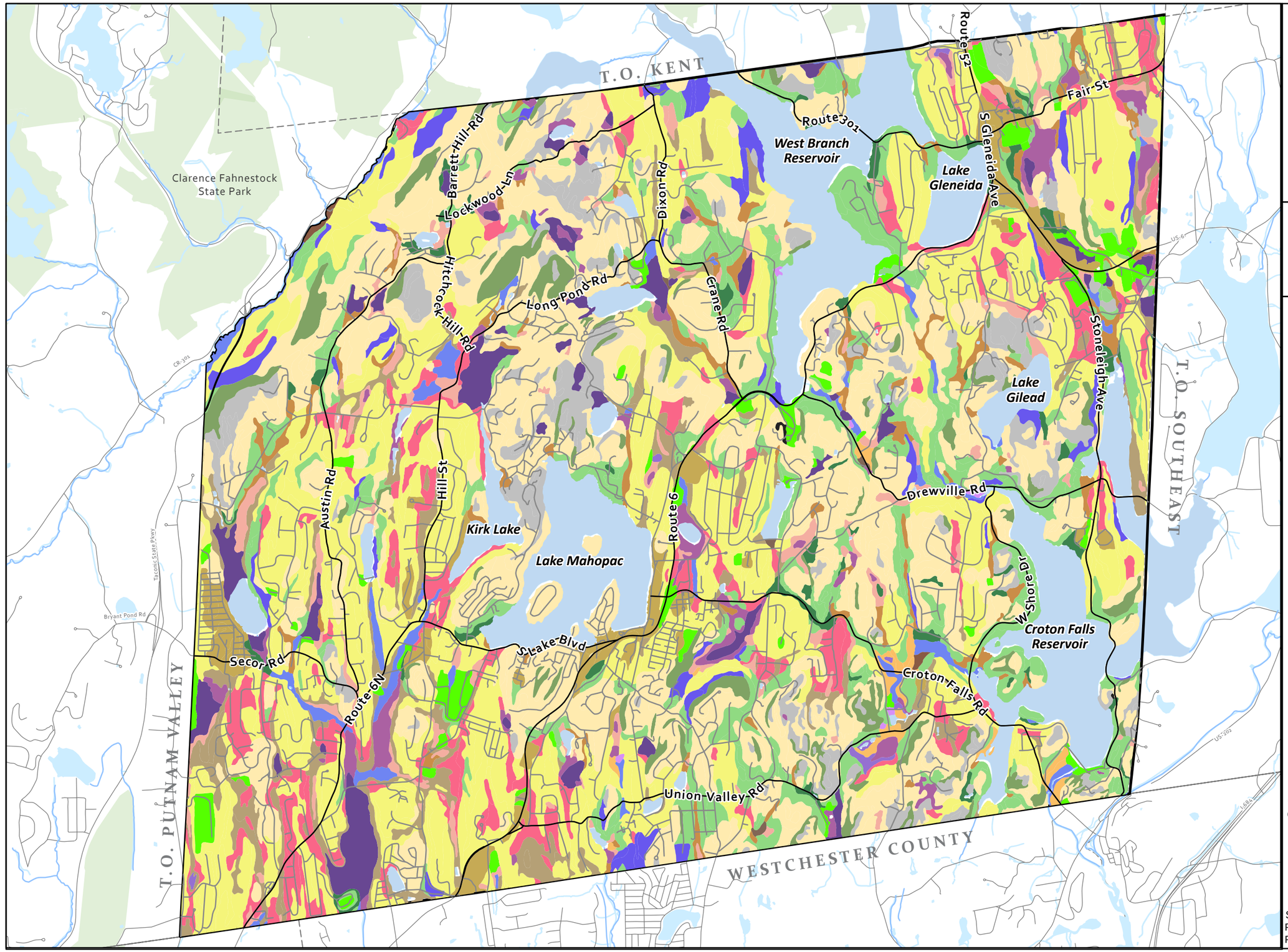
1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse

Town of Carmel

Comprehensive Plan

Map 6
Soils



Soil Group*

- Catden muck
- Charlton fine sandy loam
- Charlton loam
- Charlton-Chatfield complex
- Chatfield-Hollis outcrop
- Fluvaquents-Udifluvents complex
- Fredon silt loam
- Hinckley loamy sand
- Hollis outcrop
- Leicester loam
- Natchaug muck
- Paxton fine sandy loam
- Quarry pit
- Pompton silt loam
- Raynham silt loam
- Ridgebury complex
- Riverhead loam
- Sun loam
- Sutton loam
- Unorthents
- Urban land
- Woodbridge loam

*For detailed data see Natural Resources Conservation Service (NRCS) Soil Web Mapper

N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse; Putnam-Westchester NRCS Soil Survey

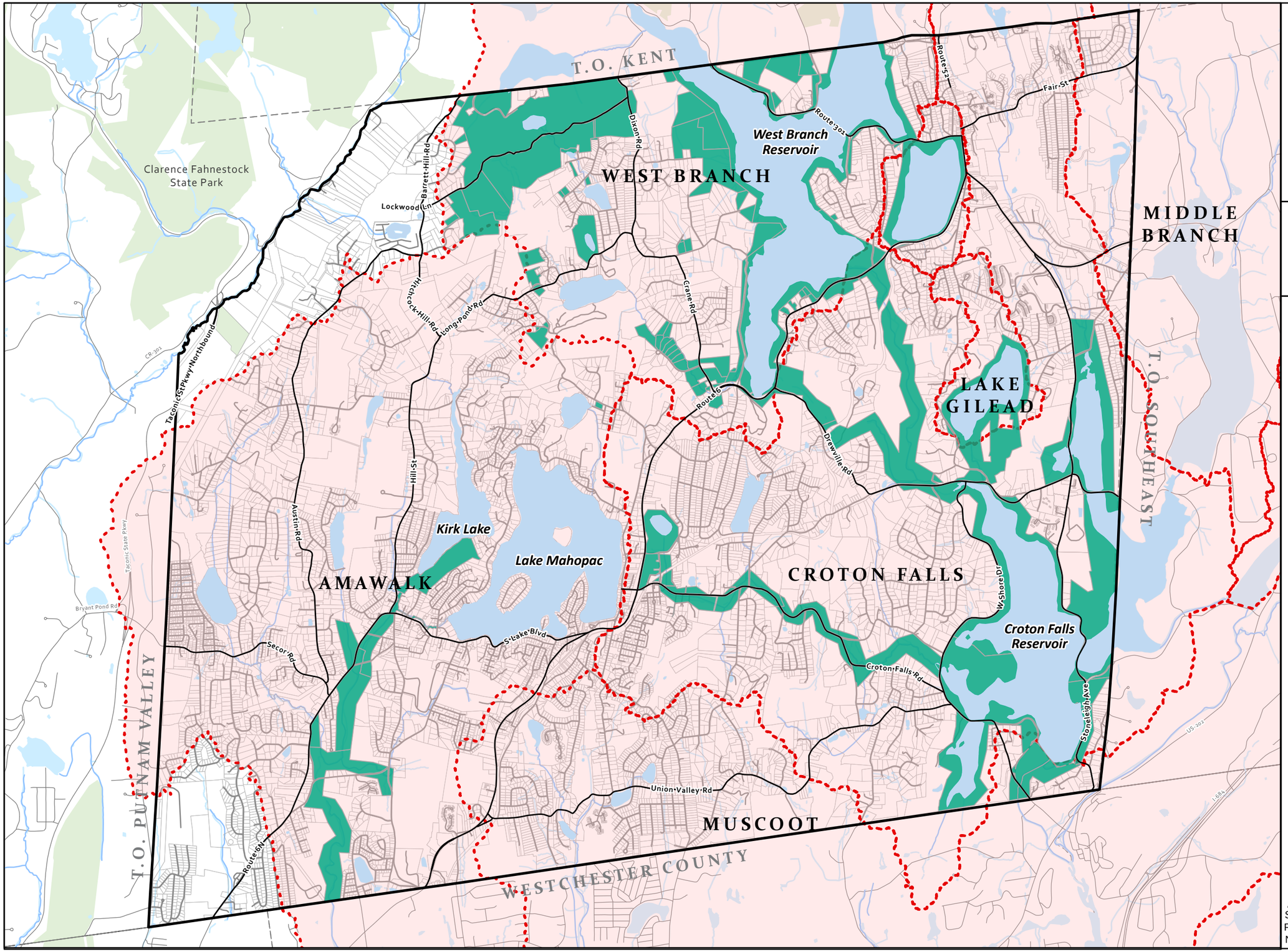
Town of Carmel

Comprehensive Plan

Map 7
NYCDEP Lands and Watershed

NYC DEP Watershed Sub-Basins

NYC DEP Land



N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse NYS DEP 2020

Town of Carmel

Comprehensive Plan

Map 8
Water Resources

- Surface Water
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Riverine
- 100 Year Floodplain
- Hydric Soils
- Aquifers
- Parcels

N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse

T.O. KENT

T.O. SOUTHEAST

T.O. PUTNAM VALLEY

WESTCHESTER COUNTY

Clarence Fahnestock State Park

West Branch Reservoir

Lake Gleneida

Lake Gilead

Kirk Lake

Lake Mahopac

Croton Falls Reservoir

Taconic State Pkwy

Tacomic Stpkwy-Northbound

Bryant Pond Rd

CR-301

Route 301

Fair St

S Gleneida Ave

US-6

Dixon Rd

Lockwood Ln

Barrett Hill Rd

Hitchcock Hill Rd

Long Pond Rd

Granet Rd

Route 6

Drewville Rd

Austin Rd

Hill Hl

W Shore Dr

S Lake Blvd

Secor Rd

Route 6N

Croton Falls Rd

Stoneleigh Ave

US-202

Union Valley Rd

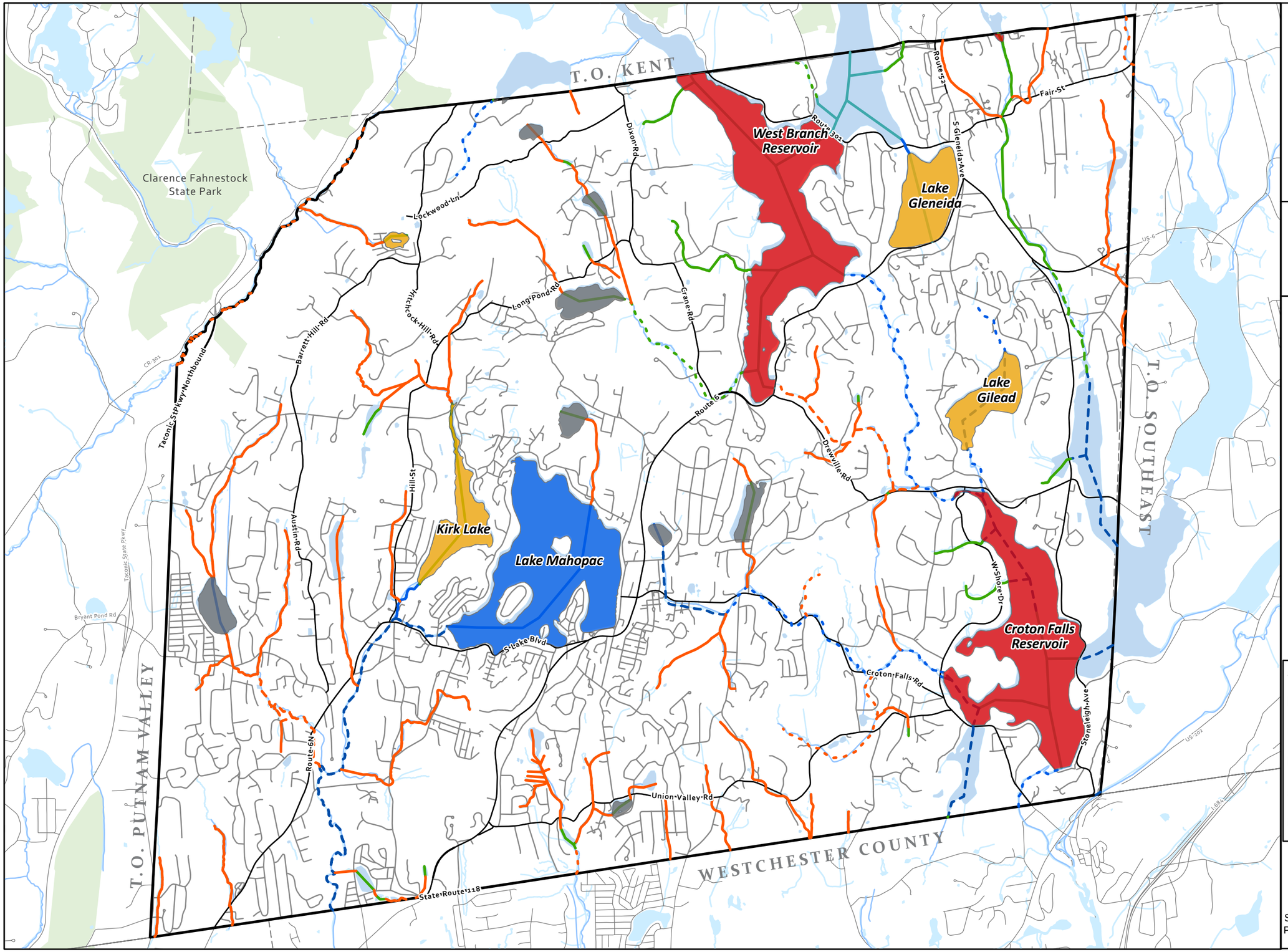
State Route 118

I-684

Town of Carmel

Comprehensive Plan

Figure 9
Water Quality Classifications



Stream Classification

- AA(T)
- A
- A(T)
- A(TS)
- B
- B(T)
- B(TS)
- C
- C(T)
- C(TS)

Water Body Classification

- Impaired
- Minor Impacts
- No Known Impact
- UnAssessed

AA/A- Drinking Water

B- Best for swimming, contact rec.

C- Best for fishing, non-contact rec.

D- Impacted

(T)- Supports Trout Populations

(TS)- Supports Trout Spawning

N

1 inch equals 1 miles

Source: ESRI Web Mapping Service; Putnam County GIS; NYS GIS Clearinghouse